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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/902,878	07/11/2001	Edward G. Combs	36080.00800	9162

7590

07/11/2003

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EXAMINER

CHAMBLISS, ALONZO

ART UNIT PAPER NUMBER

2827

DATE MAILED: 07/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/902,878	COMBS ET AL.	
	Examiner	Art Unit	
	Alonzo Chambliss	2827	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 5/6/03 (amendment A).
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 1 and 22-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-21 and 27-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>10</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 5/6/03 in Paper No. 10 was filed after the mailing date of the non-final rejection on 11/6/02. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Drawings

2. The corrected or substitute drawings were received on 10/17/02. These drawings are approved by the draftsman.

Also, the amended specification add references numerals 116-1, 116-2, 116-3, 116-4, 202-1, 202-2, 202-3, and 202-4 has overcome the objections to the drawings.

Response to Arguments

3. Applicant's arguments filed on 5/6/03 have been fully considered but they are not persuasive.

Applicant alleges that Zimmerman fails to disclose or suggest an integrated circuit package including a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package. This argument is respectfully deemed to be unpersuasive because Zimmerman is not relied upon to disclose this feature but in paragraph 12 of the rejection Long discloses a heat sink 70 (see Fig. 2) as describe in claim 3.

Applicant alleges that Zimmerman nor Long et al. either individually or in combination with one another, discloses or suggests an integrated circuit package including a substrate. This argument is respectfully deemed to be unpersuasive because Zimmerman discloses a semiconductor die 12 electrically connected to a substrate (i.e. printed circuit board) by leads 18 (see col. 3 lines 20-27).

Applicant alleges that it is not proper to combine Zimmerman with Long et al. as the examiner has suggested. Zimmerman discloses that the post 50 can be either above, below or flush with the surface of the molding compound and exposed to air. To further improve thermal performance a heat sink can be added to the top exposed surface 52 of the heat post 50 (i.e. a first heat sink) (see col. 4 lines 30-47). Long discloses a heat sink 70 partially enclosed by epoxy 60 (see Fig. 2). Thus, both Zimmerman and Long have substantially the same environment of a heat sink attached to circuit package for dissipated heat away from the die. Also, in Fig. 3 of Long one can clearly see a first heat sink 82 (i.e. similar to post 50 of Zimmerman) attached to another heat sink (see Fig. 3). Therefore, it would have been obvious to incorporate the heat sink with the device of Zimmerman, since the heat sink would provide increased surface area and irregular topography for adhering to the epoxy as taught by Long. Furthermore, in response to applicant's argument that the Examiner's conclusion of obviousness is base upon improper hindsight reasoning, it must be recognized that any judgment of obvious ness is in a sense necessarily a reconstruction base upon knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's

disclosure, such a reconstruction is proper. *In re McLaughlin*, 443 F.2d 1392; 170 USPQ 209 (CCPA 1971).

Applicant alleges that Zimmerman nor Ference et al. disclose or suggest an integrated circuit package including a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package. This argument is respectfully deemed to be unpersuasive because Zimmerman nor Ference are not relied upon to disclose this feature but in paragraph 12 of the rejection Long discloses a heat sink 70 (see Fig. 2) as describe in claim 3.

Applicant alleges that it is not proper to combine Zimmerman with Ference et al. as the examiner has suggested. This argument is respectfully deemed to be unpersuasive because Zimmerman and Ference both discloses substantially the same environment of a heat sink attached to a circuit package for dissipated heat from a chip with an adhesive material. Ference specifies that the adhesive material is a polymeric material (see col. 2 lines 62-67; Fig. 4). Therefore, it would have been obvious to incorporate the polymeric material with the device of Zimmerman, since the polymeric material is a reliable material for dissipating heat to the heat sink as taught by Ference.

Applicant alleges that Zimmerman nor Daves et al. disclose or suggest an integrated circuit package including a heat sink wherein a top portion and a side portion of the heat sink are exposed to the surroundings of the package. This argument is respectfully deemed to be unpersuasive because Zimmerman nor Dave are not relied upon to disclose this feature but in paragraph 12 of the rejection Long discloses a heat sink 70 (see Fig. 2) as describe in claim 3.

Applicant alleges that it is not proper to combine Zimmerman with Daves et al. as the examiner has suggested. This argument is respectfully deemed to be unpersuasive because Zimmerman and Daves both disclose substantially the same environment of a heat sink attached to a circuit package for dissipated heat from a chip. Daves discloses a distance between the die 600 and the thermally conductive element 103 is 3 or 4 mils while the die too is electrically connected to the substrate 500 by direct chip attachment (see col. 5 lines 8-12 and 35-42; Fig. 1). Therefore, it would have been obvious to incorporate a distance of 5 mils or less with the device of Zimmerman, since the distance would reduce the thermal path between the die 600 and the thermally conductive element as taught by Daves.

Applicant alleges that Long et al. provides no teaching or suggestion toward modifying the package of Lai et al. to include an encapsulant material encapsulating substantially all of the heat sink except a top portion and side portions of the heat sink. Also, that Long et al. provides no suggestion or teaching toward modifying the package of Lai et al to include means for encapsulating a semiconductor die, a thermally conductive element and a heat sink such that a top portion and a side portion of the heat sink are exposed to the surroundings of the package. This argument is respectfully deemed to be unpersuasive because Lai and Long both have substantially the same environment of heat sink attached to a circuit package for dissipated heat away from the chip. Thus, Long provides in Fig. 2 that a top portion and a side portion of a heat sink 70 is exposed to the surroundings of the package. Therefore, it would have been obvious to incorporate the heat sink with the device of Zimmerman, since the

heat sink would provide increased surface area and irregular topography for adhering to the epoxy as taught by Long. Furthermore, in response to applicant's argument that the Examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment of obviousness is in a sense necessarily a reconstruction based upon knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. *In re McLaughlin*, 443 F.2d 1392; 170 USPQ 209 (CCPA 1971).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a). 12.

5. Claims 2-4, 6, 10, and 27-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claim 1 above, and further in view of Long et al. (U.S. 5,175,612).

With respect to Claims 3 and 10, Zimmerman teaches a semiconductor die 40 electrically connect to a substrate by leads 18 (see col. 5 lines 16-29 and 52-56). The heat sink 50 (i.e. post for receiving heat generated from the die) has a portion thereof exposed to the surrounding of the package (see col. 1 lines 63-68; Figs. 4 and 5). The heat sink 50 has a top portion and a side portion. The thermally conductive element 42 thermally coupled with and interposed between both the semiconductor die 40 and the heat sink 50, wherein the thermally conductive element 42 does not directly contact the semiconductor die 40. An encapsulant material encapsulating the thermally conductive element 42 and the heat sink 50 such that the portion of the heat sink 50 is exposed to the surroundings of the package (see col. 6 lines 8-17; Fig. 5). Zimmerman discloses a top portion of the heat sink 50 exposed to the surroundings of the package. Zimmerman fails to disclose a top portion and a side of the heat sink exposed to the surroundings of the package. However, Long discloses a top portion and a side portion of a heat sink 70 exposed to the surroundings of the package (see Fig. 2). Therefore, it would have been

obvious to incorporate the heat sink with the device of Zimmerman, since the heat sink would provide increased surface area and irregular topography for adhering to the epoxy as taught by Long.

With respect to Claim 2, Zimmerman teaches the thermally conductive element 42 that is substantially shaped as a right rectangular solid (see Fig. 5).

With respect to Claim 4, Zimmerman teaches the thermally conductive element 42 made of alumina (see col. 6 lines 8-17).

With respect to Claim 6, Zimmerman teaches an interface element 44 interposed between the thermally conductive element 42 and the semiconductor die 40 (see Fig. 3).

With respect to Claims 27-30, Long discloses wherein the heat sink 70 comprises an extension member 78 having the side portion, wherein the extension member comprises a finger that extends from the center portion of the heat sink 70 (see Fig. 2).

6. Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claims 1 and 6 above, and further in view of Ference et al. (U.S. 6,265,771).

With respect to Claims 5 and 7, Zimmerman fails to disclose the integrated circuit package that is a ball grid array integrated circuit package with interface element that is made of polymeric material between a die and a heat sink. However, Ference discloses an integrated circuit package 40 that is a ball grid array integrated circuit package with interface element 43 that is made of polymeric material between a die 12 and a heat sink 26 (see col. 2 lines 62-67; Fig. 4). Therefore, it would have been obvious to

incorporate the polymeric material with the device of Zimmerman, since the polymeric material is reliable material for dissipating heat to the fins of the heat sink as taught by Ference.

7. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman (U.S. 5,172,213) as applied to claim 1 above, and further in view of Daves et al. (U.S. 6,091,603).

With respect to claim 8 and 9, Zimmerman fails to disclose a distance between the die and the thermally conductive element is about 5 mils or less while the die is electrically connected to the substrate by direct chip attachment. However, Daves discloses a distance between the die 600 and the thermally conductive element 103 is 3 or 4 mils while the die 600 is electrically connected to the substrate 500 by direct chip attachment. (see col. 5 lines 8-12 and 35-42; Fig. 1). Therefore, it would have been obvious to incorporate a distance of 5 mils or less with the device of Zimmerman, since the distance would reduce the thermal path between the die 600 and the thermally conductive element as taught by Daves.

8. Claims 11-13, 15, 20, 21, 31, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) in view of Long et al. (U.S. 5,175,612).

With respect to Claims 11 and 21, Lai discloses a substrate 2 comprising an upper surface with an electrically conductive trace 22 formed thereon and a lower face with a plurality of solder balls 25 electrically connected thereto, wherein the trace 22 and at least one of the plurality of solder balls 25 are electrically connected (see col. 5 lines

Art Unit: 2827

16-37; Fig. 2). A semiconductor die 3 is mounted on the upper face of the substrate 3, wherein the semiconductor die 3 is electrically connected to the trace 22. The heat sink 4 has a top portion and a plurality of side portions. The thermally conductive element 5 thermally coupled to but not in direct contact with the semiconductor die 3, wherein the thermally conductive element 5 is substantially shaped as a right rectangular solid. The thermally conductive element 5 is interposed between the die 3 and the heat sink 4 and is attached to the heat sink 4 (col. 3 lines 22-30; Fig. 2). An encapsulant material 9 formed to encapsulate the upper face of the substrate 2, the die 3, the thermally conductive element 5, and substantially all of the heat sink 4 except the top portion. Lai fails to disclose an encapsulant material encapsulating a heat sink except the top portion and the side portions. However, Long discloses a top portion and a side portion of a heat sink 70 exposed to the surroundings of the package (see Fig. 2). Therefore, it would have been obvious to incorporate the heat sink with the device of Zimmerman, since the heat sink would provide increased surface area and irregular topography for adhering to the epoxy as taught by Long.

With respect to Claim 12, Lai discloses an interface element 6 interposed between the thermally conductive element 5 and the semiconductor die 3 (see Figs. 1 and 2).

With respect to Claim 13, Lai discloses the interface element 6 in direct contact with the semiconductor die 3 by the adhesive layer 6 (see Fig. 1).

With respect to claim 15, Lai discloses the die 3 mounted on the upper face of the substrate 2 by direct chip attachment (see Fig. 2).

With respect to Claim 20, Lai discloses an integrated circuit package 1 that is a ball grid array integrated circuit package (see Fig. 2).

With respect to Claims 31 and 32, Long discloses wherein the heat sink 70 comprises an extension member 78 having the side portion, wherein the extension member comprises a finger that extends from the center portion of the heat sink 70 (see Fig. 2).

9. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Ference et al. (U.S. 6,265,771).

With respect to Claim 14, Lai-Long both fails to disclose an interface element that is made of polymeric material between a die and a heat sink. However, Ference discloses an interface element 43 that is made of polymeric material between a die 12 and a heat sink 26 (see col. 2 lines 62-67; Fig. 4). Therefore, it would have been obvious to incorporate the polymeric material with the device of Lai-Long, since the polymeric material is reliable material for dissipating heat to the fins of the heat sink as taught by Ference.

10. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Daves et al. (U.S. 6,091,603).

With respect to claim 16, Lai-Long both fails to disclose a distance between the die and the thermally conductive element is about 5 mils or less while the die is electrically connected to the substrate by direct chip attachment. However, Daves

discloses a distance between the die 600 and the thermally conductive element 103 is 3 or 4 mils while the die 600 is electrically connected to the substrate 500 by direct chip attachment. (see col. 5 lines 8-12 and 35-42; Fig. 1). Therefore, it would have been obvious to incorporate a distance of 5 mils or less with the device of Lai-Long, since the distance would reduce the thermal path between the die 600 and the thermally conductive element as taught by Daves. 18.

11. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Zimmerman et al. (U.S. 5,172,213).

With respect to Claim 17, Lai-long both fail to disclose the thermally conductive element made of alumina. However, Zimmerman discloses a thermally conductive element 42 made of alumina (see col. 6 lines 8-17). Therefore, it would have been obvious to incorporate the thermally conductive element made of alumina with the device of Lai-Long, since the thermally conductive element made of alumina would increase the thermal performance of the molded package as taught by Zimmerman.

12. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. 6,236,568) and Long et al. (U.S. 5,175,612) as applied to claim 11 above, and further in view of Shin et al. (U.S. 5,854,511).

With respect to Claim 18 and 19, Lai-Long both fail to disclose the top portion of the heat sink with plating made of nickel. However, Shin discloses the top portion (i.e. the portion of the heat sink that is expose from the package) of the heat sink 20 with plating made of nickel (see col. 2 lines 47-56 and col. 5 lines 46-54). Therefore, it would

have been obvious to substitute the heat sink with the plated nickel layer with the device of Lai-Long, since the plated nickel layer would create an easily ground and power bonding area on the heat sink as taught by Shin.

The prior art made of record and not relied upon is cited primarily to show the product of the instant invention.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning the communication or earlier communications from the examiner should be directed to Alonzo Chambliss whose telephone number is (703) 306-9143. The fax phone number for this Group is (703) 308-7722 or 7724.

Art Unit: 2827

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-7956

AC/July 7, 2003

A handwritten signature in black ink, appearing to read "Alonzo Chambliss". The signature is written in a cursive, flowing style.

Alonzo Chambliss
Patent Examiner
Art Unit 2827